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**Title: Geologic map of the Sagavanirktok B-1 Quadrangle, eastern North Slope, Alaska**

**Publication: RI 2000-1A**

**URL: <http://www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=2675>**

**Title: Interpretive bedrock geologic map of the Sagavanirktok B-1 Quadrangle, eastern North Slope, Alaska**

**Publication: RI 2000-1B**

**URL: <http://www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=2676>**

**Title: Reconnaissance surficial-geologic map of the Sagavanirktok B-1 Quadrangle, eastern North Slope, Alaska**

**Publication: RI 2000-1C**

**URL: <http://www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=2677>**

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## **I. SURFICIAL UNITS**

### **ALLUVIAL DEPOSITS**

**Qa:** Stream Alluvium—Elongate deposits of moderately to well sorted, well stratified, pebble–cobble gravel, sand, and silt, with few to numerous boulders, deposited in active stream channels, flood plains, and associated low terraces. Deposit is medium to thick bedded, locally cross bedded, and shows fining-upward cycles.

**Qac:** Abandoned-Channel Deposits—Elongate deposits of variable grain size, sorting, and bedding style deposited in channels of former meltwater streams not related to modern stream regimens and subsequent underfit streams.

**Qaf:** Alluvial Fan Deposits—Fan-shaped, heterogeneous mixtures of poorly to moderately sorted, partially stratified gravel with some sand and silt and scattered to numerous, subangular to rounded boulders, especially in proximal areas. Deposits are locally channeled across fan surface.

**Qas:** Silty Alluvium—Irregular, elongated deposits of moderately well stratified silt and minor fine sand deposited by streams traversing areas of thick silt cover. May include fine-grained debris-flow deposits, especially in the upper reaches adjacent to actively melting frozen silt deposits. Lower reaches may be deeply incised.

**Qat:** Terrace Alluvium—Elongate deposits of well sorted, well rounded to subrounded pebble-cobble gravel and sand with trace to some silt and rare to numerous boulders forming stream terraces bordering flood plains. Deposits reflect former channels and flow regimes related to multiple Wisconsin-age glaciations in the stream headwaters.

**Qfp:** Floodplain Alluvium—Elongate deposits of moderately to well sorted, well-stratified, fluvial gravel, sand, and silt with few to numerous boulders in flood plains and associated low terraces. Deposits may reflect former channels and flow regimes.

## **COLLUVIAL DEPOSITS**

**Qc:** Undifferentiated Colluvium—Irregular, heterogeneous blankets, aprons, and fans of angular to subrounded rock fragments, gravel, sand, and silt that are left on slopes, slope bases, or high-level surfaces by residual weathering and complex mass-movement processes, including rolling, sliding, flowing, gelifluction, and frost creep.

**Qca:** Colluvial–Alluvial Valley Fill, Fan and Apron Deposits—Fan- and tongue-shaped and elongate heterogeneous mixture of subangular rock fragments and pebble–cobble gravel with some sand and silt deposited at the bases of steep walls and upper stream courses primarily by debris flows and brief, intense (torrential) summer stream flows.

**Qcr:** Talus and Rubble Deposits—Irregular cones, drapes, and sheets of coarse (1 m diameter and larger blocks are common), heterogeneous, angular rock fragments and rubble with minor silt, sand, and gravel deposited more or less in place at the base of steep slopes by block weathering, frost riving, snow avalanches, free fall, tumbling, rolling, and sliding.

**Qdf:** Debris–Fan Deposits—Fan-shaped heterogeneous mixture of sand, silt, and gravel with rare to numerous angular rock fragments deposited at the mouths of steep bedrock couloirs by debris flows and seasonal meltwater. Surface smooth to locally irregular.

## **GLACIAL DEPOSITS (Echooka Drift)**

**Qde:** Undifferentiated Drift of Echooka Age—Heterogeneous blanket of pebble–cobble gravel, sand, and silt, with rare to numerous boulders. Deposited directly from glacial ice and by glacial meltwater.

**Qdme:** Moraine Deposits of Echooka Age—Heterogeneous mounds and ridges of pebble–cobble gravel, sand, silt, and clay in varying proportions deposited directly from glacial ice; contains rare to numerous boulders. Clast roundness varies from rounded to subangular.

**Qoe:** Outwash Deposits of Echooka Age—Elongate heterogeneous mixture of washed, rounded to subrounded pebble–cobble gravel with some sand and silt and scattered to numerous subangular to rounded boulders deposited by meltwater streams draining margins of former glaciers.

**Qofe:** Outwash Fan Deposits of Echooka Age—Fan-shaped heterogeneous mixture of washed, rounded to subrounded pebble–cobble gravel with some sand and silt and scattered to numerous subangular to rounded boulders deposited by meltwater streams draining margins of former glaciers.

## **GLACIAL DEPOSITS (Itkillik Drift)**

**Qdir:** Reworked Drift of Itkillik Age—Heterogeneous blanket of pebble–cobble gravel, sand, silt, and clay in varying proportions deposited by glaciers; contains rare to numerous boulders deposited directly from glacial ice. Sorting, bedding, and clast roundness highly variable, depending on degree of water reworking.

**Qdmi:** Moraine Deposits of Itkillik Age—Heterogeneous mounds and ridges of pebble–cobble gravel, sand, silt, and clay in varying proportions deposited directly from glacial ice; contains rare to numerous large (1 m diameter and greater) angular to subangular boulders.

**Qfdi:** Fan-Delta Deposits of Itkillik Age—Fan-shaped deposit of sand and pebble gravel laid down near margin of former meltwater lake by stream entering lake. Well sorted and medium to massive bedded, locally cross bedded.

#### **GLACIAL DEPOSITS (Sagavanirktok River Drift)**

**Qdms:** Moraine Deposits of Sagavanirktok River Age—Heterogeneous mounds and ridges of pebble–cobble gravel, sand, silt, and clay in varying proportions deposited directly from glacial ice. Forms prominent broad, arcuate ridge that encircles younger Itkillik-age moraines where Echooka River exits the mountain front.

**Qds:** Undifferentiated Drift of Sagavanirktok River(?) Age—Very thin and patchy veneer of pebbles, cobbles, and boulders deposited directly from glacial ice of Sagavanirktok age and older. Commonly preserved as only a scattered lag of exotic cobbles and boulders on ice-scoured bedrock and bedrock rubble.

#### **COMPLEX DEPOSITS**

**Qs:** Swamp Deposits—Elongate to blanket deposits of complexly interbedded peat, organic silt, and organic sand accumulated as surface deposits in local basins and in former stream channels, and downslope from springs and seeps. Saturated and locally frozen and ice rich.

**Qsr:** Retransported Silt—Heterogeneous blankets, fans, and aprons of silt and organic silt originally laid down by eolian processes and subsequently extensively reworked by fluvial and colluvial processes; includes silt-rich debris-flow deposits. May contain angular clasts of local origin.

**Qsu:** Perennially Frozen Silt, Undifferentiated—Irregular blankets of massive, generally homogeneous, unconsolidated silt of eolian origin, largely retransported from original hillside sites of eolian deposition to lower slopes and valley bottoms by mud flows, slope wash, and gullying.

**Qts:** Thawed Silt Deposits—Heterogeneous blankets of poorly to moderately stratified silt and organic silt generally equivalent to Qsu unit and subsequently extensively modified by extreme melting of ice-rich permafrost and overland stream flow.

#### **MANMADE DEPOSITS**

**Qh:** Artificial Fill Deposits—Pebble–cobble gravel with trace to some sand and silt forming base for drill pad. Well to poorly sorted. Surface smooth.

## II. BEDROCK UNITS

### BROOKIAN SEQUENCE

**Tkp:** Prince Creek Formation (Upper Cretaceous to lower Tertiary)—Light gray, ‘salt and pepper’, brown-weathering, medium to coarse grained, moderately sorted, subangular to subrounded, massive to laminated, locally cross-bedded, sandstone, pebbly sandstone, and granule conglomerate. In map area, exposures are mostly limited to stream cuts along Fin Creek and Shaviovik River.

**Kc:** Canning Formation (Upper Cretaceous) (Molenaar and others, 1987)—Dark gray to medium gray, locally calcareous and bentonitic, interbedded, fine- and very-fine-grained, moderately well sorted sandstone, siltstone, and shale. Sandstone is typically rhythmically layered, laterally continuous, with planar and cross-bedding, thin-bedded, with local medium and thick beds.

**Kphu:** Pebble shale and Hue Shale unit, undifferentiated (Lower to Upper Cretaceous) (Molenaar and others, 1987)—Poorly exposed black, fissile, laminated clay shale containing scattered rounded chert pebbles and frosted quartz grains (pebble shale unit), overlain by bentonitic clay shale, thin-bedded (2–10 cm thick) silicified tuff beds with fissile black organic-rich shale interbeds, and thin bentonite seams (Hue Shale) which, where exposed, weather from yellow-gray to bright orange-red.

### ELLESMERIAN SEQUENCE

**Kkb:** Kemik Sandstone, bioturbated facies (northern facies belt)—Medium gray to dark brownish-gray, very-fine-grained quartz arenite; consists principally of intensely bioturbated sandstone and silty sandstone that appears to gradationally overlie Kingak Shale.

**Kkm:** Kemik Sandstone, massive facies (southern facies belt)—Medium gray, very-fine-grained, dominantly well bedded, laminated, homogenous quartz arenite; unconformably overlies Kingak Shale at a sharp basal contact; forms rubble-covered ridges that support abundant black lichens that yield a distinctive very dark gray to black character on aerial photographs.

**Kjk:** Kingak Shale (Jurassic to Lower Cretaceous) (Leffingwell, 1919)—Black fissile clay shale and soft silty claystone; contains pyrite and scattered chert and quartz pebbles, common clay ironstone, and pyrite-bearing concretions and ironstone layers. Locally contains minor very-fine-grained sandstone interbeds with ironstone concretions.

**Tru:** Triassic rocks, undifferentiated—Includes Shublik Formation, Ivishak Formation, and Kavik Shale as described below. Undifferentiated unit is mapped along the mountain front in western part of map area where extensive rubble cover prevents delineation of individual units.

**Trs:** Shublik Formation (Middle to Upper Triassic) (Leffingwell, 1919)—Organic-rich, dark gray to black, phosphatic, medium- to thin-bedded bioclastic limestone with interbedded calcareous siltstone and shale, and minor calcareous sandstone. Limestone beds and interbedded shale are generally sooty, locally contain fetid odor, and contain abundant compressed pectinoid pelecypods, *Halobia* sp. And *Monotis* sp.

**Tri:** Ivishak Formation (Lower Triassic) (Detterman and others, 1975)—Dark gray, fine-grained quartz sandstone grading to siltstone, light tan-brown- to red-brown-weathering, overall in coarsening- and thickening-upward packages 2–5 m thick, with thin- to medium-bedded (up to 8 cm) sandstone with interbedded siltstone partings.

**TriK:** Ivishak Formation, Kavik Shale Member (Lower Triassic)—Dark gray to black silty shale and very thin- bedded to thinly laminated siltstone. Unit is characterized by recessive weathering, has limited outcrop in the map area, and is typically exposed only as rock-chip rubble. Unit grades upward into sandstone of the Ivishak.

**Pe:** Echooka Formation (Permian) (Keller and others, 1961)—The Echooka Formation crops out along the Philip Smith Mountains front as prominent dark cuestas that contrast with the underlying light-colored Lisburne Group and the overlying recessive Kavik member of the Ivishak Formation.

**IPMlu:** Lisburne Group, upper part—Medium to light gray, very light gray to buff weathering, thin- to very thick- bedded, interbedded lime mud and bioclastic grainstone and wackestone that is commonly crinoidal, and subordinate buff-weathering dolostone. Locally massive beds have no visible internal structures, but some beds contain coral fossil hash.

**IPMlm:** Lisburne Group, middle part—Medium gray and dark gray banded, medium-gray-weathering interval that is transitional between upper and lower Lisburne map units; difficult to differentiate from upper Lisburne in some exposures.

**Mll:** Lisburne Group, lower part—Sooty black, dark-gray-weathering, recessive mudstone and wackestone interval that mostly forms slopes consisting of small rubble blocks. Distinct thin (~10–40 cm) beds where well exposed, with subordinate thicker and more resistant interbeds.

**Mky:** Kayak Shale (Lower to Upper Mississippian) (Bowsher and Dutro, 1957)—Dominantly black, sooty, fissile shale and silty shale, with subordinate siltstone, quartz sandstone, and dark-gray- to maroon weathering silty limestone, lime mudstone, and wackestone.

**Mkt:** Kekiktuk Conglomerate (Lower Mississippian) (Brosgé and others, 1962)—Medium gray, light gray to tan-brown and orange-brown-weathering, very-fine-grained sandstone, siltstone, and silty shale, with subordinate amounts of medium-grained quartzose sandstone, chert- and quartz-granule conglomerate, and minor anthracitic coal.

## **FRANKLINIAN SEQUENCE**

**pM:** Pre-Mississippian rocks, undifferentiated—Dominantly calcareous quartz semischist with subordinate calcareous pelitic siltstone, and black and pale green phyllite. Quartz semischist weathers orange-brown, tan-brown, tan-gold, and gray, and comprises very-fine- to fine-grained rounded detrital quartz grains, and light tan-brown to gold mica.

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